2.3. LAND MANAGEMENT

Land management measures are land based techniques and practices that seek to influence flood generation by reducing the amount of surface runoff reaching the river network. They achieve this primarily by improving soil structure (e.g. making it more porous), increasing infiltration, and ultimately increasing the capacity of the land to store water. In addition to reducing runoff, these measures can also reduce soil erosion and the transfer of sediment and pollutants to rivers.

Substantial bodies of evidence confirm that land management practices affect runoff generation although the effect of these changes on the propagation of flood waters downstream is less clear[34,35]. The overall effect on flood generation will be influenced by a number of factors such as the spatial location and the scale of the intervention, the extent of the landscape areas and river channel reaches affected, and the relative timings of runoff contributions[36]. O'Connell et al.[8] provide further information on the features of a catchment that influence the effect of land management on flood generation, while Halcrow[37] provides an overview of the evidence base.

The following describes some of the main land management measures associated with reducing runoff generation for the purpose of reducing surface water flooding and the amount of water reaching the river network. Other measures that can contribute to reductions in runoff exist, particularly those relating to rural sustainable drainage systems (rural SuDS), and further details of these can be found in the suggested further reading. Due to the uncertainty in the effects of land management measures on flooding, these measures should not be viewed as mutually exclusive of other measures described in this chapter. The greatest benefits to flooding will frequently be achieved by implementing many different types of measures together.

2.3.1. Land and soil management practices

WHAT IS IT?

Incorporating good practice into the management of land for the purpose of increasing infiltration of water and sediments into soils and reducing surface runoff.

The land's ability to slow down and store runoff is influenced substantially by how agricultural land is managed. Activities which result in a higher risk of soil erosion and soil compaction and leave less vegetative cover over the winter can reduce the potential for infiltration of surface runoff and associated pollutants (Figure 2.13). Certain land management practices such as high stocking densities, the use of heavy machinery and leaving soils un-vegetated over the winter can present particular risks.

The adoption of good land and soil management practices can reduce the risks to soil posed by certain land management practices and in many cases can improve overall yield by improving the productivity of soils (e.g. by relieving compaction and improving root penetration). These practices typically seek to improve soil structure and/or increase cover so as to reduce erosion, increase soil infiltration, and reduce runoff and transport of sediments. A variety of techniques may be adopted including:

- cover crops;
- checking for and relieving compaction where required;
- soil aeration;
- machinery practices that minimise compaction; and
- runoff control features (e.g. in-field buffer strips, hedges).

Figure 2.13. Soil erosion in an arable field in West Somerset (© National Trust).

2.3.1.1. Technical considerations

Soil and crop management measures

Over-wintering fields with a cover crop (typically grass or clover that is grown to provide cover rather than leave bare soil) reduces soil erosion and maintains soil structure and fertility thus reducing surface runoff. Cover crops also provide a host of additional benefits including a reduction in the leaching of nutrients, weed control and the provision of habitat for many species. Such techniques can be challenging to implement but can be successful where there are drier, more stable soils[38].

Undertaking soil cultivations along contours, rather than straight up and down field slopes, can be particularly effective in reducing surface runoff (although this needs to consider the safety risk of doing so). Carrying out regular assessments for soil compaction and taking any required action to remedy this such as sub-soiling can also help. Reducing the impact of machinery on soil compaction, for example, by increasing tramline spacing, using flexible tyres, decreasing loads, and using the correct tyre pressure can also increase infiltration and reduce runoff, particularly on weakly structured, wet soils[39]. The use of a soil aerator (mechanical spiking of the soil) and tramline management techniques can also improve infiltration in compacted grass fields and tramlines while also benefiting growth by increasing the amount of oxygen reaching roots (Figure 2.14).

Figure 2.14. A soil aerator being used to aerate a field previously subject to heavy grazing pressure and compaction (© Tweed Forum).

Runoff control features

The creation of vegetated strips of land running along the banks of watercourses (riparian buffer strips) can provide protection from grazing, stabilise banks, and reduce erosion and the amount of water and pollutants reaching the watercourse, while also improving biodiversity. This may be as simple as erecting fencing to allow natural regeneration and protection from stock or may include some additional elements such as planting of trees and other vegetation.

Sub-dividing arable fields through the planting of grass strips and hedgerows (Figure 2.15) along the contour of a field or within a natural gully can be particularly effective at intercepting surface runoff and increasing infiltration of water into the soil profile. Strategic placement of field entrances in locations that do not permit surface runoff to exit the field quickly, such as may be the case where entrances are located next to main roads, can also reduce connectivity with the river network. In general, the longer and steeper the slope and the less free draining the adjacent field is, the wider the grass strip or riparian buffer that is needed to slow and intercept runoff.

Other agricultural practices and interventions that can contribute to reductions in runoff, such as ditch/drain blocking and wetland creation, are described in more detail in subsequent sections.

2.3.1.2. Cost

The cost of adjusting soil and crop management practices or installing runoff control features is typically low but must be considered in conjunction with effects on yield. The purchase of specialist soil management and cultivation machinery can be much higher although it may be possible to reduce costs by renting such machinery or purchasing with neighbouring landowners/managers. A number of payments are available in the Scottish Rural Development Programme (in targeted areas) to support good land and soil management practices (see Chapter 8).

Figure 2.15. Newly planted hedgerow in the Bowmont Water catchment, Scottish Borders: This hedgerow has been planted along the contour to intercept surface runoff (© Tweed Forum).

Further reading and guidance

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